

Habitat preferences of the Otway Black Snail *Victaphanta compacta* (Cox and Hedley, 1912) (Rhytididae)

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Abstract

A survey in August–October 2004 determined the distribution of the Otway Black Snail *Victaphanta compacta* at three locations in the Otway Ranges. *V. compacta* was found in Temperate Rainforest (gullies), Wet Forests (ridges) and the ecotone between these two (slope) and was found predominantly around the base of trees and in leaf litter, and fewer were found associated with logs and or the tree trunks. (*The Victorian Naturalist* 124 (4) 2007, 204–209)

Introduction

The Otway Black Snail *Victaphanta compacta* Cox and Hedley, 1912 is a land snail endemic to the Otway Ranges, Victoria. *V. compacta* belongs to the family Rhytididae, carnivorous land snails found in southern Africa, the western islands of the Pacific, New Guinea, New Zealand and Australia (Smith 1971, 1977, 1998; Smith and Kershaw 1979; Meads *et al.* 1984).

The four species in the genus *Victaphanta* are characterised by thin, light shells primarily made of conchin (a protein matrix) with very little calcareous material (Smith and Kershaw 1979). The shapes of their shells range from spherical to sub-spherical and the shell colouring ranges from black, dark brown, through to light yellow (Smith and Kershaw 1979). The body is predominantly black, with three of the species exhibiting orange colouration on the foot (*Victaphanta milligani* Pfeiffer, 1853), mantle frill (*Victaphanta atramentaria* Shuttleworth, 1853, *V. milligani* and *Victaphanta lampra* Reeve, 1854) or in the mucus (*V. atramentaria* and *V. lampra*) (Smith and Kershaw, 1979). *Victaphanta* is restricted to south-eastern Australia occurring within the Wet Forests and Cool Temperate Rainforests of Victoria and Tasmania; all four species are found in leaf litter (Smith and Kershaw 1979).

Victaphanta compacta is aptly named the Otway Black Snail (Figs. 1 and 2) as its shell colour is predominantly a glossy



Fig. 1. Otway Black Snail *Victaphanta compacta*.



Fig. 2. Otway Black Snails *Victaphanta compacta*, mating.

black in the outer whorls with a small patch of yellow/white on the inner whorl (Smith and Kershaw 1972, 1979). The shell colour can vary between individuals ranging from yellow to dark brown (Smith 1970) as well as black. The diameter of the shell ranges from 20 to 28 mm (Gabriel 1930; Smith 1970; Smith and Kershaw 1979). The colour of the body of the snail is also black (Smith 1970; Smith and Kershaw 1979).

Victaphanta compacta is easily diagnosed by its lack of orange pigmentation anywhere on the body or in the mucus (Smith 1970) and distinguished from its closest relative *Victaphanta atramentaria* by a smoother and more spherical shell (Gabriel 1930; Smith 1970).

Little is known on the biology of *V. compacta* except that the snail is carnivorous (Smith 1971) and lays white eggs with a diameter of 2-3 mm (Smith 1970). It is not known how long these snails live. No information on the behaviour of *Victaphanta compacta* is available.

Victaphanta compacta is endemic to the Otway Ranges of southern Victoria (Smith 1977; Smith and Kershaw 1979) and is found in Wet Forests and Cool Temperate Rainforests (Smith 1977). Cool Temperate Rainforests have a patchy distribution within the Otway Ranges, being restricted to deep, sheltered gullies with moist conditions and at the headwaters of creeks and rivers throughout the region (VEAC 2003). Wet Forests occur on mountain sides with high rainfall and in wet valleys (Conn 1993). Wet Forests are also found emerging from the Cool Temperate Rainforests, called Mixed Forests as they contain a mix of Wet Forests and Cool Temperate Rainforests flora (Ashton and Attiwill 1994). Cool Temperate Rainforest has an overstorey of Myrtle Beech *Nothofagus cunninghami* and Blackwood *Acacia melanoxylon*, while the Wet Forests are dominated by Mountain Ash *Eucalyptus regnans*, Mountain Grey Gum *E. cypellocarpa* and Messmate *E. obliqua*. Both vegetation types have tree-ferns.

The IUCN Species Commission Mollusc Specialist Group listed *Victaphanta compacta* with the IUCN as *Endangered* in 1996. It was given a Red listed category of E A2c, due to a potential for the species to

experience a 50% reduction in population within the next ten years because of habitat loss (World Conservation Union 2003). It is listed as *Threatened* under the Victorian *Flora and Fauna Guarantee Act 1988* (SAC 2001) because of possible population decline due to loss of habitat caused by Myrtle Wilt destroying the canopy layer, and human activities, and because the species is endemic with a limited distribution and low abundance.

Part of the requirement of a listing under the *Flora and Fauna Guarantee Act 1988* is the preparation of an Action Statement that includes background information and species description, the distribution, habitat and life history of the species, and recommendations for conservation (Butcher *et al.* 1994). Before any actions can be recommended for the conservation of *V. compacta*, information is required on its distribution, abundance, age structure of populations, and reproductive rates and success. This survey is part of a study that investigated some of the information that is lacking for *Victaphanta compacta* (Burrell 2004). It assessed the habitat and shelter site preferences of *V. compacta* by determining whether:

1. It is found in Wet Forest (ridge), Cool Temperate Rainforest (gully), or the Mixed Forest (the ecotone on the slope between the ridge and gully) habitats.
2. It has a preferred shelter site between habitat types and overall shelter site preferences. The shelter types are defined as base (of trees and tree ferns), leaf litter, logs or vertical (trunk). This will determine whether *V. compacta* shelters in specific areas within its habitat or if the species is a generalist in microhabitat choice.

Study Area

The Otway Ranges are located on the south coast of Victoria and are approximately 2110 km² in area (Conn 1993). Elevations range from 670 metres at Mt Cowley (VEAC 2003) down to sea level along the coast. The geology of the area is primarily of non-marine sandstones and shales, and the soils consist of fertile loams, which support extensive forests (Conn 1993). The average rainfall for the area is between 1750 mm and 2000 mm

with the highest rainfall period from May to September. Temperatures vary from the mid-summer maximum of 20-27°C to the mid-winter minimum of 3-4°C. The Ranges can also receive light snowfall at the higher elevations during winter (VEAC 2003).

The area investigated in this study includes from west of Lavers Hill, up to Beech Forest, Forrest, across to east of Lorne, to Apollo Bay and along the coast back to Lavers Hill

Methods

One of the most common forms of survey method used to investigate mollusc diversity, habitat preferences, abundance, distribution and biology is the quadrat survey method. It is thought that measured searches such as quadrat surveys provide the most accurate snail counts when compared to casual searches (Mesibov 1998; Stringer and Montefiore 2000). In the present study, quadrat surveys were used as habitat preferences were being investigated.

Quadrat survey method

The method used for this study was adapted from Taylor *et al.* (1994) who used timed searches of one hour per 10 x 10 m plot, focusing on potential shelter sites of land snails. In this study, 10 x 10 m quadrats also were used and searched for a total of one hour in all potential snail shelter sites. Smith and Kershaw (1979) reported that *Victaphanta compacta* is found in leaf litter, and Taylor (1991) and Taylor *et al.* (1994) list other potential mollusc shelter sites such as logs, the leaf litter around trees and tree-ferns and the tops of ferns. The shelter sites where live snails and dead shells were recorded and classed into four categories included:

1. Leaf litter: snails found on top and underneath open leaf litter;
2. Tree/tree-fern base: snails found around the bases of trees and tree-ferns;
3. Logs: snails found on, around and underneath logs; and
4. Vertical shelter sites: snails found in the crowns of tree-ferns and in the crevices of trees less than two metres in height.

Quadrats were first visually scanned to locate any active snails, then searches for live snails were conducted by overturning leaf litter and logs by hand and by using

small gardening forks. The crowns of ferns were searched gently by hand, and logs were overturned by hand. Everything was replaced after searching and it was thought that no snail would be injured or killed by this method. Shell diameters of all live snails were recorded as a measure of age class.

Site selection

Quadrat surveys were conducted in three sites in each of three locations. The locations were chosen by consulting 1:100 000 BIOMAPs and 1:25 000 Topographic maps of the Otway Ranges. Locations were selected first for their suitability of habitat for the snails (Wet forest and Cool Temperate Rainforest) and for their similarity in elevation and aspect. Similar elevation and aspect were needed so that the three locations would be statistically comparable. The three locations chosen for the quadrat surveys were: Mt Sabine Falls (38°37'58"S 143°44'58"E), Beauchamp Falls (38°39'04"S 143°36'25"E), and Grey River Road (38°38'45"S 143°46'10"E).

The elevation at Mt Sabine Falls is 490 m on the ridge, and the location has a SSW aspect. Mt Sabine Falls was surveyed on 28 August, 9 September and 11 September 2004. Beauchamp Falls has an altitude of 440 m on the ridge and a SSE aspect; it was surveyed on 11-12 September 2004. Grey River Road has an elevation of 520 m on the ridge and a SSW aspect; it was surveyed on 21-22 October 2004.

Three habitats were surveyed within each location: ridge, slope and gully habitat. Site 1 – ridge habitat included the ridge top and slope down to 50 metres, Site 2 – slope habitat included the area between the ridge and gully sites and Site 3 – gully habitat included the valley floor, riparian zones and slope up to 50 metres.

Five quadrats were surveyed in each site for a total of 15 quadrats for each location. In each site the quadrats were placed randomly. Forest types were recognised using the criteria set out by Cameron (1992).

Statistical analysis

Univariate ANOVAs were performed using the SPSS 11.0 for Windows program to investigate individual location habitat and shelter site preferences, and the *post hoc* Tukey test was used to detect where

any significant difference lay. Analysis was performed with the guidance of Kirkpatrick and Feeney (2003). Some of the data were recorded as zeros or low numbers; therefore, to normalise the data before statistical analysis, log transformation was used, $X' = \text{Log}(x + 1)$ (Zar 1999).

Results

Habitat preferences

A total of 148 live snails was recorded on the ridges, slopes and gullies at the three locations. Fifty-nine snails were recorded at Mt Sabine Falls with 12 (20.3%) on the ridge, 17 (28.8%) on the slope, and 30 (50.9%) in the gully. At Beauchamp Falls, 49 snails were recorded with 19 (38.8%) on the ridge, 13 (26.5%) on the slope, and 17 (34.7%) in the gully. Grey River Road had 40 snails, with 27 (67.5%) on the ridge, eight (20%) on the slope, and five (12.5%) in the gully.

The data from the three locations was pooled and statistically analysed. No significant difference was detected ($P=0.434$) between locations and between habitat types. This suggests that the locations were statistically similar in the numbers of snails per habitat type and that *Victaphanta compacta* has no distinct preference for habitat (Wet Forest on ridges, Mixed Forest on slopes, and Cool Temperate Forest in the gully).

Shelter site preferences

The numbers of live *V. compacta* found in each shelter site (base, litter, logs or vertical shelter sites) for the three habitats at the three locations are provided below.

Mt Sabine Falls

In the ridge habitat a total of six (50%) snails was found in the base shelter site, three snails (25%) were found in leaf litter, two (16.7%) were found in the log shelter site and one (8.3%) was found in the vertical shelter site. In the slope habitat a total of seven (41.2%) snails was recorded for the base shelter site, seven snails (41.2%) were found in leaf litter and three (17.7%) were found in the log shelter site; no snails were recorded in the vertical shelter site. In the gully habitat a total of 16 (53.3%) snails was recorded for the base shelter site, five snails (16.7%) were found in leaf

litter, eight (26.7%) were found in the log shelter site and one (3.3%) was found in the vertical shelter site.

Beauchamp Falls

In the ridge habitat a total of 11 (57.9%) snails was recorded in the base shelter site, seven snails (36.8%) were found in the leaf litter and one (5.3%) was found in the log shelter site; no snails were found in the vertical shelter site. The slope habitat had a total of nine (75%) snails in the base shelter site and three (25%) in the leaf litter; no snails were found in the log and vertical shelter sites. The gully habitat had a total of seven (53.9%) snails in the base shelter site and six (46.2%) in the leaf litter; no snails were found in the log and vertical shelter sites.

Grey River Road

The ridge habitat had a total of 11 (40.7%) snails in the base shelter site, 13 (48.2%) in the leaf litter and three (11.1%) in the log shelter site; no snails were found in vertical shelter site. The slope habitat had a total of three (42.9%) snails in the base shelter site and four (57.1%) in the leaf litter; no snails were recorded for the log and vertical shelter sites. The gully habitat had a total of two (40%) snails in the base habitat and three (60%) snails in the leaf litter; no snails were found in the log and vertical shelter sites.

Analyses of the pooled raw data for the three locations showed that *Victaphanta compacta* occurred equally in base shelter sites and leaf litter shelter sites and then log shelter sites and rarely in vertical shelter sites as only two individuals were recorded in this shelter site.

Statistical analysis of the pooled data from the three locations showed a significant difference ($P<0.001$). A post hoc Tukey test revealed that the difference lay between the overall preferences between shelter sites. Base shelter sites did not significantly differ from leaf litter ($P=0.621$), base shelter sites significantly differed from logs ($P<0.001$), base shelter sites significantly differed from vertical shelter sites ($P<0.001$), leaf litter significantly differed from logs ($P=0.006$) and from vertical shelter sites ($P<0.001$). No significant difference was detected between logs and

vertical shelter sites. This suggests that the number of snails within each shelter site did not differ between ridge, slope and gully and between the three locations. However *Victaphanta compacta* showed an overall preference between shelter sites, preferring base and leaf litter shelter sites to log and vertical shelter sites

Discussion

Habitat

Statistical analysis showed that *V. compacta* occurred equally between the three habitats, suggesting that the species has no preferred habitat type between Wet Forest, Mixed Forest and Cool Temperate Rainforest.

Smith (1977) listed the habitats for *Victaphanta compacta* as the Wet Forests and Cool Temperate Rainforests of the Otway Ranges, whereas all other references list the species as only occurring within the Cool Temperate Rainforests including Gabriel (1930), Smith (1970), Smith and Kershaw (1979) and the *Flora and Fauna Guarantee Act 1988* (SAC 2001) under which the species is listed as 'Threatened' because of its restricted habitat (i.e. Cool Temperate Rainforests in the Otway Ranges). However the present study has not only supported Smith's (1977) recording of Wet Forests as well as Cool Temperate Rainforests in the Otway Ranges as *V. compacta*'s habitat, but it has also suggested that the species occurs equally within these habitat types and in the boundaries between the two (i.e. Mixed Forests).

Shelter Sites

Statistical analysis of the combined data revealed that *Victaphanta compacta* showed a preference between the four shelter sites surveyed in this study. The species was found to be equally occurring around the bases of trees and tree ferns as well as leaf litter and was less likely to be found in the log shelter sites. The study recorded that *V. compacta* is unlikely to be recorded in sites that are above the ground up to two metres suggesting that the species is not arboreal.

Smith and Kershaw (1979) reported that *Victaphanta compacta* could be found in the leaf litter in the Cool Temperate

Rainforests of the Otway Ranges. The present study found this to be true and expanded it to include areas around the base of trees and tree ferns and to a lesser extent logs in both Cool Temperate Rainforests and Wet Forests of the Otway Ranges.

The present study found that *V. compacta* prefers the base of trees and tree ferns and leaf litter, rather than log shelter sites and rarely vertical heights. The endangered New Zealand carnivorous land snail, *Paryphanta busbyi watti*, also hides under leaf litter in dense vegetation during the day (Stringer *et al.* 2003). That the logs are not a significant shelter site for *V. compacta* is interesting, as for most invertebrates, logs are an important aspect of their habitat requirements (Taylor 1991; Taylor and Doran 2001). In the case of *V. compacta*, it is still unknown whether logs may affect environmental conditions that enable this species to inhabit these forests.

Other observations

Most Rhytididae snails are nocturnally active (Smith 1998), but some are active during the day in wet weather (Meads *et al.* 1984). *Victaphanta compacta* is primarily nocturnal, but during this study 62 individuals were found to be active during the day; however, all observations were on days of wet weather. The mating behaviour of some carnivorous land snails can take several days (Stringer *et al.* 2003); four pairs of mating *V. compacta* were observed during September in this study, and Fig. 2 shows a mating pair connected by their everted reproductive organs.

Conclusions

This project assessed the distribution of the Otway Black Snail in different topographies in the Otway Ranges. It was found in Temperate Rainforest (gullies), Wet Forests (ridges) and in the ecotone between these two (slope). Within these areas, *V. compacta* was found predominantly around the base of trees and in leaf litter. This suggests that leaf litter is an important microhabitat for this species, and factors that threaten the leaf litter layer could have adverse effects on *V. compacta*.

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